3 TRAFFIC

This chapter will address the existing and future traffic operations associated with the US 550 South connection. Existing traffic operations are based on data collected in 2013 and 2014. The future operations are based on traffic volumes provided in the *US 160 at US 550 SEIS – Traffic Reports Technical Review* (Fehr & Peers, 2014) for the year 2035; these operational evaluations were applied to the On-Alignment and Off-Alignment Alternatives discussed throughout this report, along with a No-Action Alternative. For the purpose of this analysis, the study area is bounded by US 160 on the north, CR 220 on the south, SH 172 on the east, and US 550 on the west.

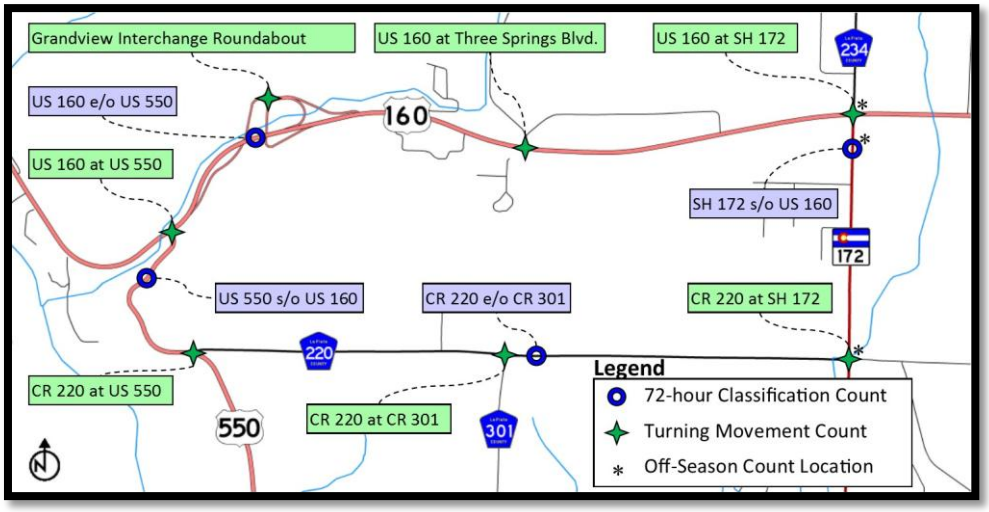
3.1 EXISTING CONDITIONS

The existing conditions (traffic volumes and operations) for the roadways and intersections within the study area are based on data collected at two times: In August 2013, which is representative of the higher levels of traffic Durango experiences in the summer season, and in January 2014, during the off-peak season when the Florida Mesa Elementary School is in session. The summarized traffic count data from the August 2013 and January 2014 counts are provided in Appendix AA.

3.1.1 Data Collection

Existing peak-season traffic counts include weekday peak-period turning movement counts at intersections and 72-hour tube counts (Tuesday through Thursday), which gathered volume and vehicle classification data by direction. The count locations and study area are shown in **Figure 3-1** and described in greater detail below.

Figure 3-1: Vicinity Map and Traffic Count Locations



- Peak-season weekday peak-period turning movement counts (7 to 9 AM, 4 to 6 PM):
  - Grandview interchange, north roundabout
  - US 160 at US 550
  - US 160 at Three Springs Blvd.
  - US 160 at SH 172
  - CR 220 at US 550

- CR 220 at CR 301
- CR 220 at SH 172

- Peak-season 72-hour directional volume and classification counts (Tuesday, Wednesday, and Thursday):
  - US 550, south of US 160
  - US 160, east of US 550
  - SH 172, south of US 160
  - CR 220, east of CR 301

In addition, counts were collected during the winter, when the Florida Mesa Elementary School is in session, to determine what influence (if any) the school traffic has on SH 172. According to the CDOT automated traffic recorders placed on US 160 in Durango and Bayfield, the seasonal low occurs about three to six weeks after the beginning of the calendar year. Therefore, this additional count data was collected in the last week of January 2014 at the following locations:

- Off-season weekday peak-period turning movement counts (7 to 9 PM, 4 to 6 PM):
  - US 160 at SH 172
  - CR 220 at SH 172
- Off-season 72-hour directional volume and classification counts (Tuesday, Wednesday, and Thursday):
  - SH 172, south of US 160

Classification Count Summary

The vehicle classification counts were summarized from the high-season raw data into four vehicle categories: bikes, cars, buses, and trucks. The bikes category typically includes motorcycles but may also capture bicycle traffic. The cars category generally includes passenger car, SUV, and pickup truck vehicle types as well as single unit, two-axle trucks (which includes pickup trucks with six wheels). The buses category includes both transit vehicles and school buses. The trucks category includes all larger trucks including single-unit trucks with three or more axles and multi-trailer semis. The average weekday volumes from the 72-hour counts are summarized in **Table 3-1**.

Table 3-1: Classification Count Summary (August 2013)

Location	Bikes	Cars	Buses	Trucks[1]	Total
US 550, south of US 160	110	7,247	89	485 (6%)	7,931
US 160, east of US 550	352	22,729	47	1,377 (6%)	24,505
SH 172, south of US 160	114	9,386	11	246 (3%)	9,757
CR 220, east of CR 301	33	1,305	3	75 (5%)	1,416

[1] Truck Volume (% Trucks)

Turning Movement Count Summary

The peak-period turning movement counts were collected in mid-August 2013, during the same week as the tube counts. A supplemental count was required at the CR 220 intersection with US 550 due to missing data for movements between the south US 550 approach and east CR 220 approach. The supplemental counts were completed in October 2013 and were comparable to the August counts after

adjusting for seasonal variations. The reported traffic volumes are a composite of the two counts, balanced as necessary to match the volumes from the August counts on the northbound US 550 approach.

The turning movement counts and the average weekday traffic volumes from the data collection efforts, which represent peak-season traffic levels, are shown in **Figure 3-2**.

January 2014 Count Summary

The additional count data gathered in January 2014 was studied to determine if the off-season traffic showed any significant difference in patterns that might affect the analysis. The average weekday volumes from the August 2013 and January 2014 72-hour counts are provided in **Table 3-2**.

Table 3-2: SH 172 Classification Count Comparison

Location	Date	Bikes	Cars	Buses	Trucks[1]	Total
SH 172, south of US 160	Aug. 2013	114	9,386	11	246 (3%)	9,757
SH 172, south of US 160	Jan. 2014	93	8,477	70	177 (2%)	8,817

1 Truck Volume (% Trucks)

The overall traffic volumes along SH 172 were lower in the off-season than during the summer. It is also worth noting that the number of buses was substantially higher in January, likely due to the fact that school was in session.

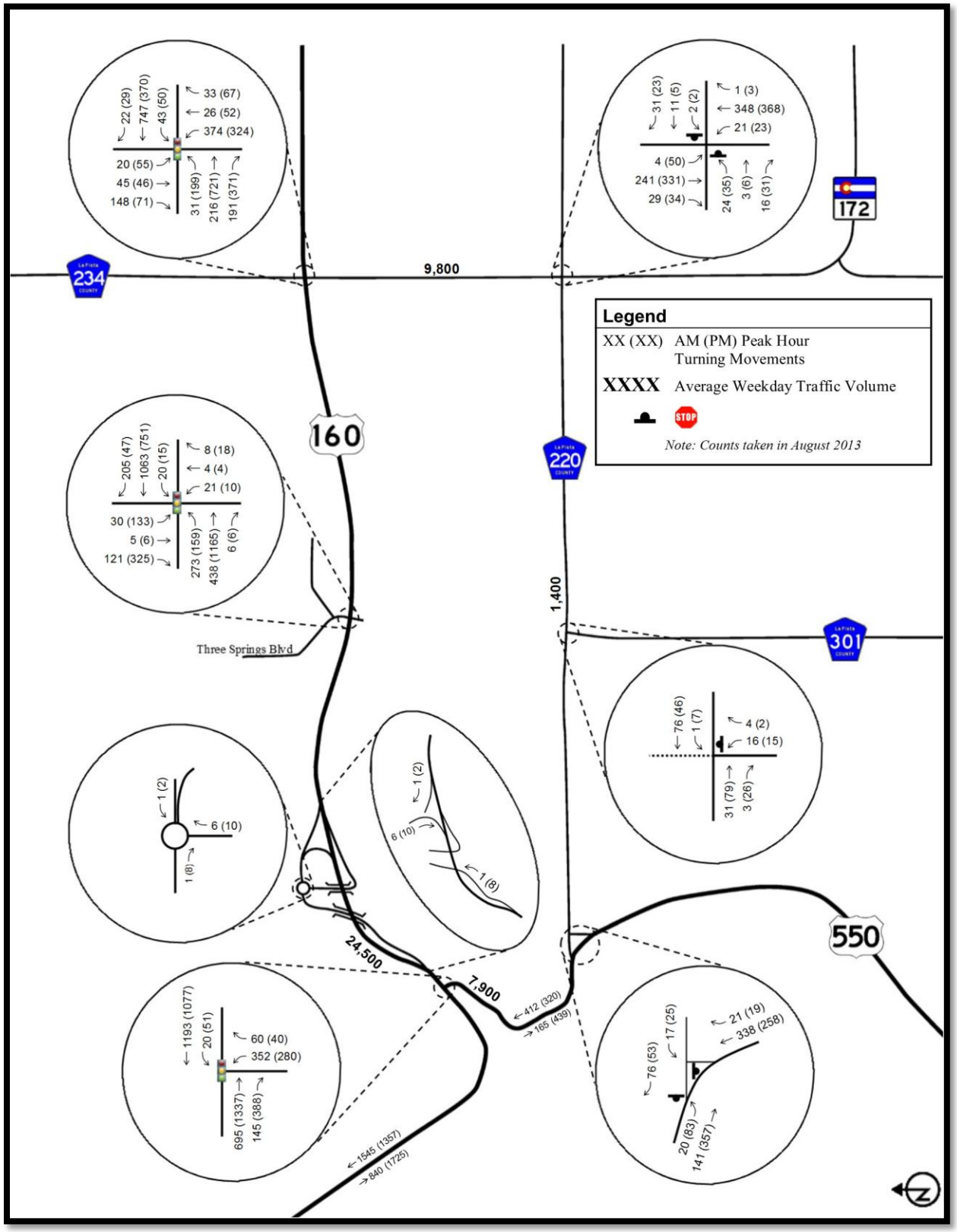
Table 3-3 provides a comparison of the turning movement counts collected in August 2013 vs. the January 2014 counts. The additional traffic shown during the AM peak period may be a reflection of school traffic.

Table 3-3: SH 172 Turning Movement Count Comparisons

Movement	SH 172 at US 160				SH 172 at CR 220			
	August 2013		January 2014		August 2013		January 2014	
	7–9 AM	4–6 PM	7–9 PM	4–6 PM	7–9 PM	4–6 PM	7–9 PM	4–6 PM
EB Left	69	345	57	340	48	65	41	54
EB Thru	441	1,355	366	1,229	3	13	4	12
EB Right	343	689	*425*	629	28	53	26	49
WB Left	69	101	*110*	74	3	6	3	3
WB Thru	1,296	715	1,327	565	17	10	14	11
WB Right	55	64	42	36	47	45	*77*	*51*
NB Left	636	594	699	564	35	34	*43*	16
NB Thru	54	89	46	*120*	621	659	604	618
NB Right	77	125	74	97	2	7	2	*32*
SB Left	28	92	18	76	7	78	*22*	71
SB Thru	69	88	70	97	410	656	445	655
SB Right	265	127	*303*	114	48	62	39	62

1 Numbers in *RED* indicate January 2014 counts that were more than 10% higher than in August 2013
Note: Volumes represent the full 2-hour count period

Figure 3-2: Existing Traffic Volumes



3.1.2 Operations Analysis

Traffic operations for the corridor were analyzed in accordance with the procedures from the *Highway Capacity Manual* (HCM) (Transportation Research Board, 2010). Level of Service (LOS) is a qualitative measure of traffic operational conditions based on capacity and motorist delay. LOS is graded from A to F, with A meaning no delays and F signifying significant delays (or gridlock). For signalized intersections, LOS is reported for the signal as a whole, but can also be assessed for individual movements. For unsignalized intersections, LOS is reported only for movements that must yield the right-of-way and not for free-flow movements. For basic highway segments and interchange ramp merge/diverge segments, LOS is based on the density of the roadway section in terms of vehicles per mile per lane.

The results of the operational analysis for each intersection and ramp merge/diverge segment are shown in **Figure 3-3**.

Signalized Intersection LOS Results

There are three signalized intersections on US 160 within the study area: at US 550 (Farmington Hill), Three Springs Blvd., and SH 172. The signal timing used in the analysis was provided by CDOT. The intersection and movement LOS results are provided in **Table 3-4** and shown in **Figure 3-3**.

Table 3-4: Signalized Intersection LOS

Intersection	Peak Period	Eastbound			Westbound			Northbound			Southbound			ALL
		L	T	R	L	T	R	L	T	R	L	T	R	
US 160/US 550	AM	-	D	C	D	-[1]	-	C	-	A	-	-	-	**B**
	PM	-	C	B	D	-[1]	-	D	-	C	-	-	-	**C**
US 160/Three Springs Blvd.	AM	C	A	A	D	B	A	D	D	A	D	D	A	**B**
	PM	D	B	A	D	B	A	D	D	A	C	D	A	**B**
US 160/SH 172	AM	A	A	A	B	B	B	D	D	A	D	D	A	**C**
	PM	B	B	B	B	B	B	D	D	A	D	D	A	**C**

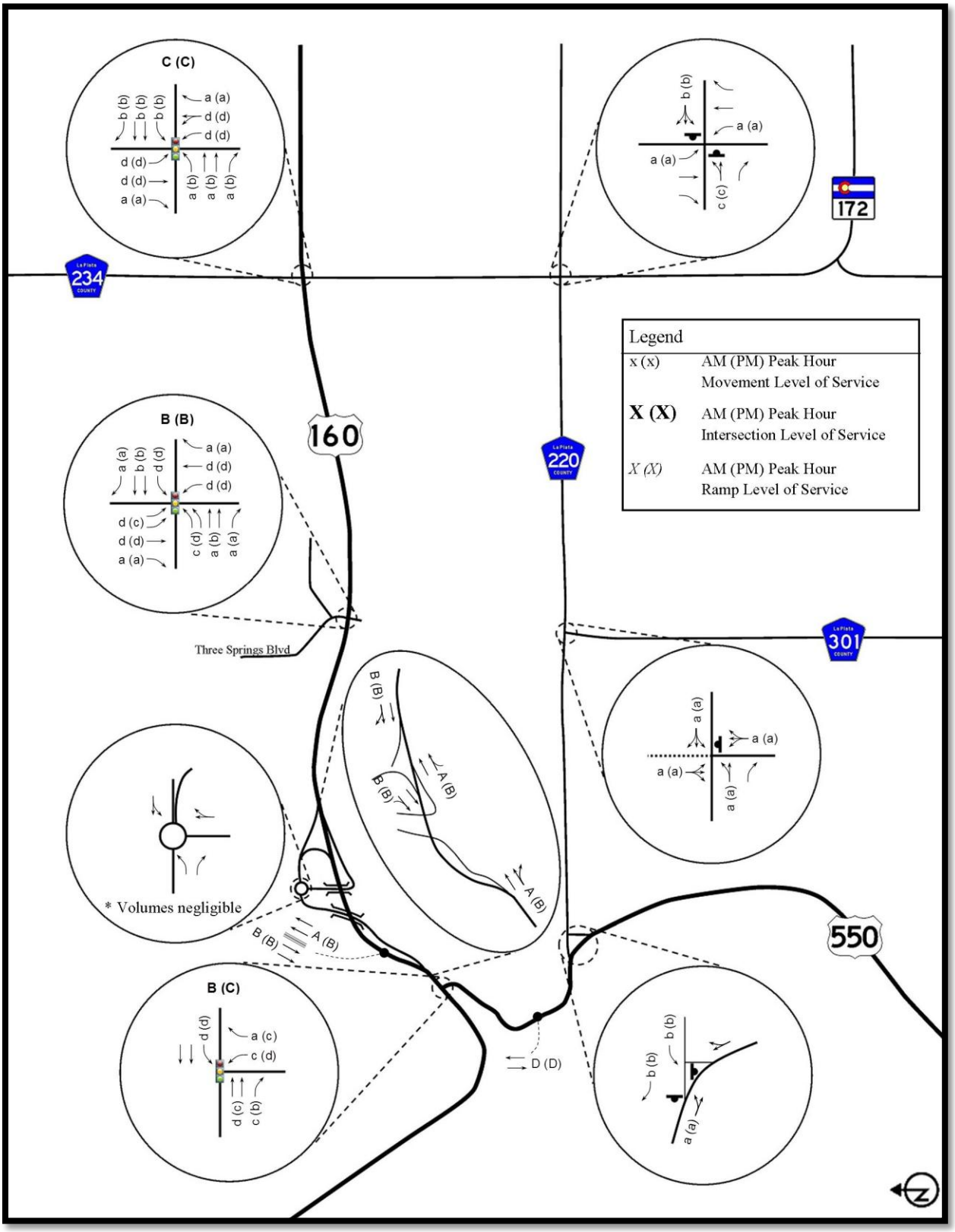
[1] Westbound through is a free-flow movement at this intersection

All three intersections operate at LOS C or better during the peak periods under August 2013 traffic conditions. Individual movements also operate at acceptable levels (LOS D or better) during the peak times.

January 2014 Operations

According to the counts collected in January 2014, the US 160/SH 172 intersection continues to operate at LOS C or better with minimal impact to individual movements.

Figure 3-3: Existing Conditions LOS Results



Unsignalized Intersection LOS Results

Three unsignalized intersections on CR 220 within the study area were analyzed: those at US 550, CR 301, and SH 172. The unsignalized movement LOS results are provided in **Table 3-5** and illustrated in **Figure 3-3**.

Table 3-5: Unsignalized Intersection LOS

Intersection	Peak Period	Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
CR 220/US 550	AM	-	-	-	B	-	B	-	-[1]	A	A	-[1]	-
	PM	-	-	-	B	-	B	-	-[1]	A	A	-[1]	-
CR 220/CR 301	AM	-	-[1]	A	A	-[1]	-	A	-	A	A	-	-
	PM	-	-[1]	A	A	-[1]	-	A	-	A	A	-	-
CR 220/SH 172	AM	C	C	A	B	B	B	A	-[1]	A	A	-[1]	A
	PM	C	C	A	B	B	B	A	-[1]	A	A	-[1]	A

[1] Movement not subject to intersection delay

In general, the unsignalized movements operate at LOS B or better during both the AM and PM peak periods. The eastbound approach to the CR 220/SH 172 intersection shows LOS C for both peak periods, but queues are typically limited to one or two vehicles.

January 2014 Operations

According to the January 2014 traffic counts, the eastbound and westbound approaches to the CR 220/SH 172 intersection were slightly worse during the AM peak period (LOS D and LOS C, respectively) but otherwise remained unchanged.

Roundabout Intersection LOS Results

The roundabout intersection on the north side of the Grandview interchange was not reviewed as part of this existing conditions analysis. This was because the current traffic volumes through the roundabout are extremely low, with fewer than 10 conflicting vehicles per hour across any one approach. Delay calculated for such low volumes would be negligible.

Highway LOS Results

Traffic operations for US 160 were assessed between the signalized intersections with US 550 at Farmington Hill and Three Springs Blvd. Within this segment, highway traffic operations are primarily dictated by the highway merge/diverge segment for the Grandview interchange, except for the segments between the eastbound off-ramp and the westbound on-ramp.

The eastbound US 160 off-ramp could be considered a weaving segment due to the proximity of the US 160/US 550 intersection at Farmington Hill (approximately 550 feet away). However, the northbound right-turn movement from US 550 to eastbound US 160 is a protected-only movement, with an overlap phase during the westbound left-turn phase. As a result, the eastbound US 160 traffic does not conflict with the northbound right-turn traffic and no weaving movements occur; therefore, diverge segment analysis is applicable. The geometry of the eastbound off-ramp would be equivalent to a diverge from a two-lane highway segment with a 415-foot-long parallel deceleration lane.

The highway segment LOS results illustrated in **Figure 3-3** are detailed in **Table 3-6**. It should be noted that traffic volumes for the eastbound on-ramp to US 160 were not available because of a direct frontage road connection to the ramp. Instead, an estimate based on the westbound off-ramp from US 160 was used.

Table 3-6: US 160 Highway Segment LOS

Segment	Off-Ramp		Mainline		On-Ramp	
	AM	PM	AM	PM	AM	PM
US 160 eastbound	A	B	A	B	A	B
US 160 westbound	B	B	B	B	B	B

The density along US 160 varies between six and 16 passenger car equivalents per mile per lane; speeds are estimated at 49 to 51 miles per hour (mph). Delays through the Grandview interchange area caused by on-ramp and off-ramp traffic should therefore be minimal at current traffic levels.

US 550 LOS Results

The existing traffic operations analysis for US 550 is slightly different than the US 160 analysis, as US 550 is a two-lane directional highway. Using the HCM two-lane-highway analysis, US 550 currently operates at LOS D during the AM and PM peak periods; this is in part due to the lack of passing zones and relatively high proportion of trucks on the steep grade on Farmington Hill.

3.2 FUTURE CONDITIONS (2035)

Future traffic conditions (traffic volumes and operations) were evaluated for the intersections and interchanges along US 550 and US 160 for the On-Alignment and Off-Alignment Alternatives, plus the No-Action Alternative.

Traffic Analysis Alternatives

Through this Independent Alternatives Analysis, several combinations of alignments, intersection configurations, interchange layouts, and other design features were reviewed in varying levels of detail. However, in terms of traffic operations, most of the differences are simply nuance that do not translate to changes in traffic operations. Thus, the traffic component of the alternative evaluation can be reduced to three main alternative groups, along with a small subset of traffic-related configuration details:

- **No-Action Alternative:** In this option, no changes to the existing roadway network are made; this is consistent with the *2006 US 160 Environmental Impact Statement (EIS)* No-Action Alternative as modified by the inclusion of completed construction projects and the future Wilson Gulch Rd.
- **On-Alignment Alternative:** This alternative calls for the reconstruction of US 550 along its existing alignment with a connection to US 160 close to the existing Farmington Hill intersection; this alternative has two primary configurations:
  - An improved signalized intersection
  - A new grade-separated interchange (R5 Alternative)
- **Off-Alignment Alternatives:** In these scenarios, CDOT would eliminate the current US 550 connection to US 160 at Farmington Hill and realign US 550 to connect to the Grandview interchange; there are two primary configurations in this alternative:

- An unsignalized T-intersection (RGM)
- A multi-lane roundabout (RGM6)

US 160 Future Lane Geometry Assumptions

The lane geometry assumed for US 160 was consistent with the geometry defined in the 2006 US 160 EIS Preferred Alternative layouts, plus the already completed construction projects (CDOT; FHWA, 2006). For future conditions, US 160 on the west end of the study corridor has a six-lane cross section; the outside lanes in the eastbound and westbound direction are dropped and added at the Grandview interchange off-ramp and on-ramp, respectively. Between the on-ramps and off-ramps, there are two through lanes and one auxiliary lane in each direction between the Grandview interchange and Three Springs Blvd. (six-lane cross section). The Three Springs Blvd. and SH 172 intersections are each converted to a single-point urban interchange (SPUI) with a four-lane cross section on US 160 through SH 172 to the east. Except where necessary to connect the additional ramps for the On-Alignment Alternative, this base lane geometry is maintained. A copy of the *2006 US 160 EIS* Preferred Alternative lane alignments from the west end of the study corridor through Three Springs Blvd. is provided in Appendix Z.

3.2.1 2035 Traffic Volumes

The traffic volumes used for this analysis were developed as part of the comprehensive, independent review of the technical reports associated with the *2006 US 160 EIS* and *2012 Supplemental Final Environmental Impact Statement (SFEIS)* documents. The independent methodology and technical assumptions used in generating the 2035 traffic forecasts is documented in the *US 160 at US 550 SEIS – Traffic Reports Technical Review* (Fehr & Peers, 2014), which is provided in Appendix F.

2035 No-Action and Signalized On-Alignment Alternatives Volumes

The 2035 traffic volumes are the basis for the No-Action Alternative analysis and are shown in **Figure 3-4**. These traffic volumes would also apply if US 550 were reconstructed on its current alignment and the signalized intersection with US 160 at Farmington Hill maintained.

2035 On-Alignment Alternative Volumes

The construction of a new interchange with US 160 at Farmington Hill would results in several minor changes in the traffic assignment at the interchange; however, the underlying volumes within the study area would remain unchanged (shown on **Figure 3-5**).

2035 Off-Alignment Alternatives Volumes

The traffic assignment resulting from realigning US 550 to connect to the existing Grandview interchange is shown in **Figure 3-6**. The traffic volumes on US 160 east of the Grandview interchange, as well as volumes east or south of the US 550/CR 220 intersection, would remain unchanged.

Figure 3-4: 2035 Traffic Volumes for No-Action and Signalized On-Alignment Alternatives

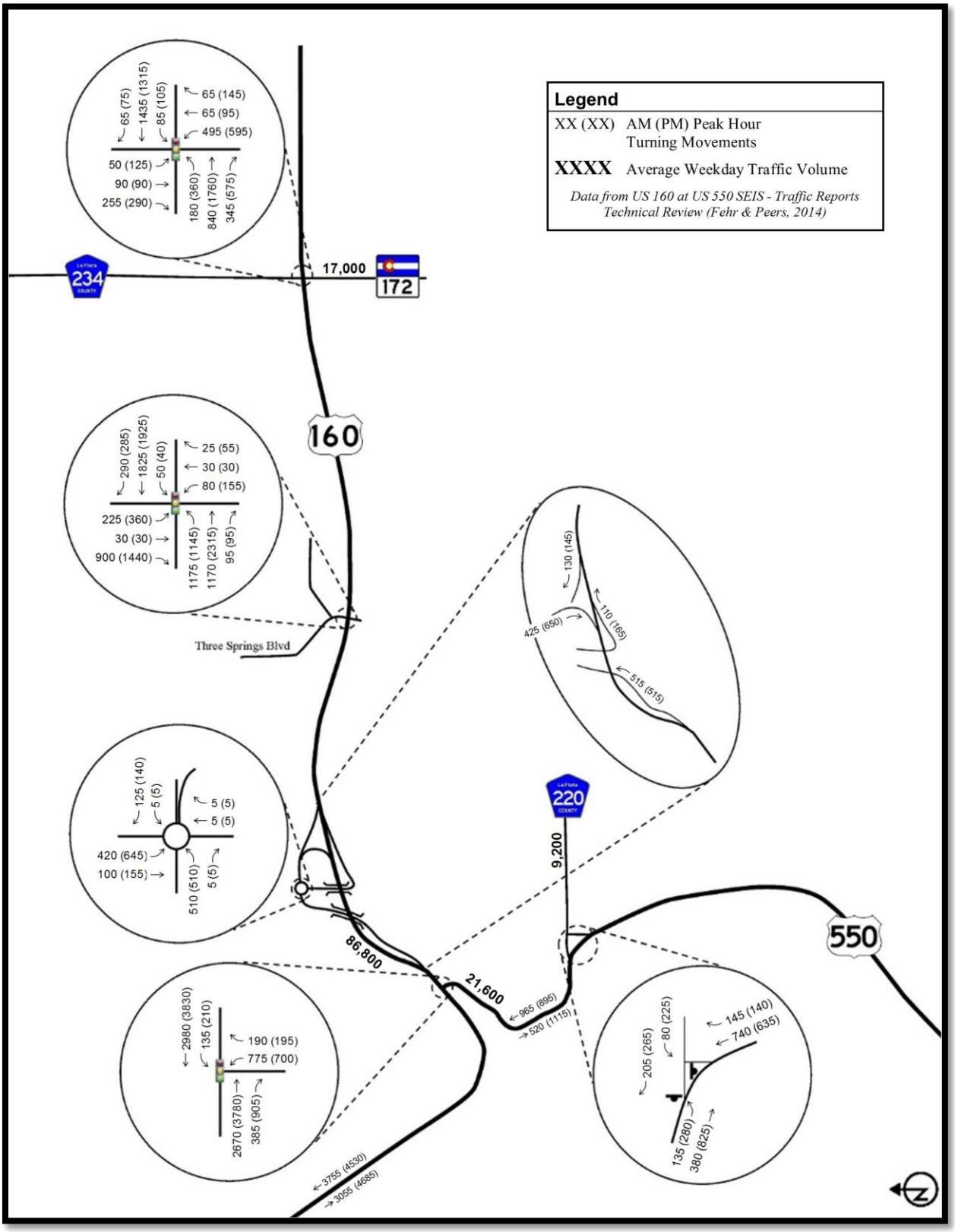


Figure 3-5: 2035 Traffic Volumes for On-Alignment Alternative

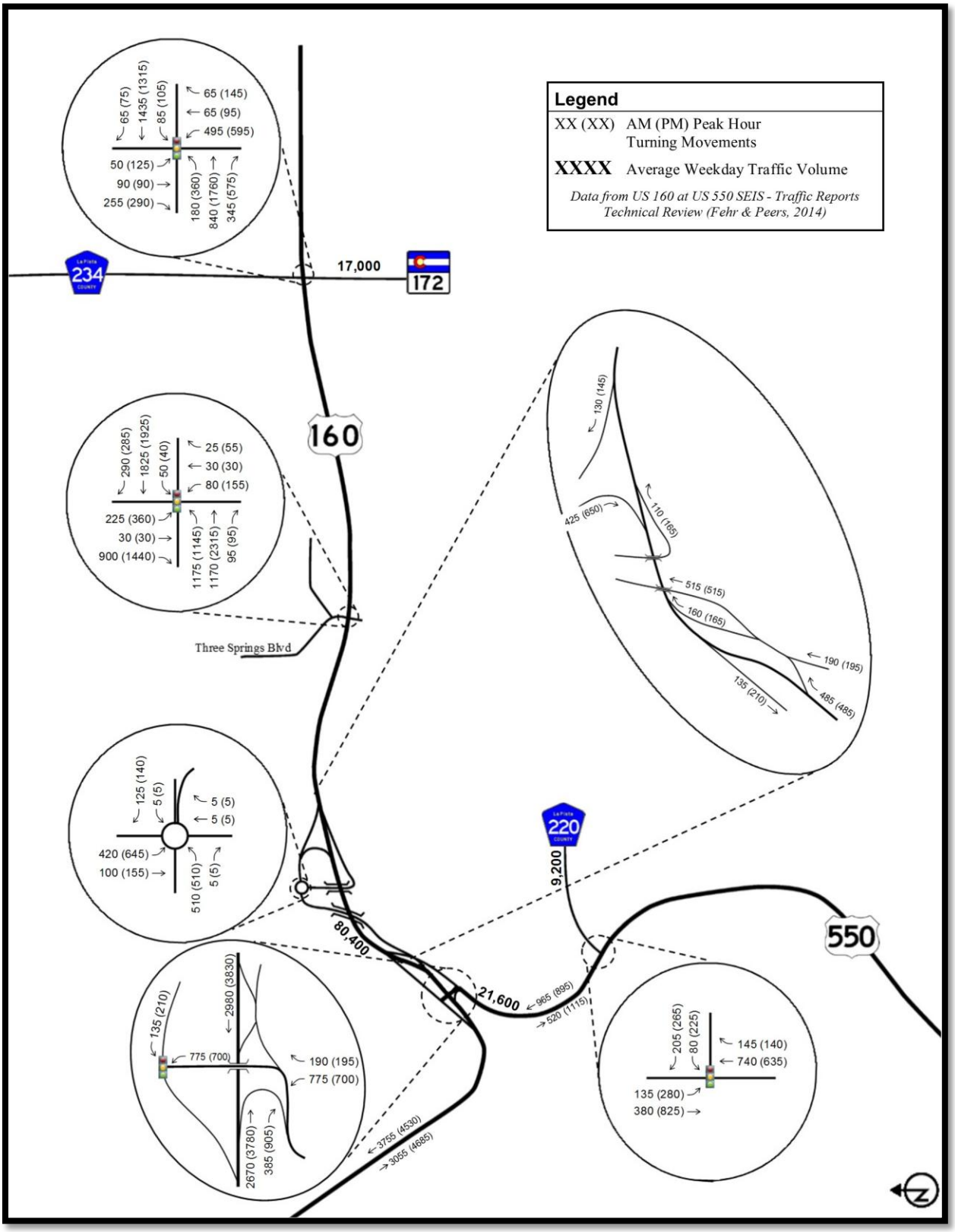
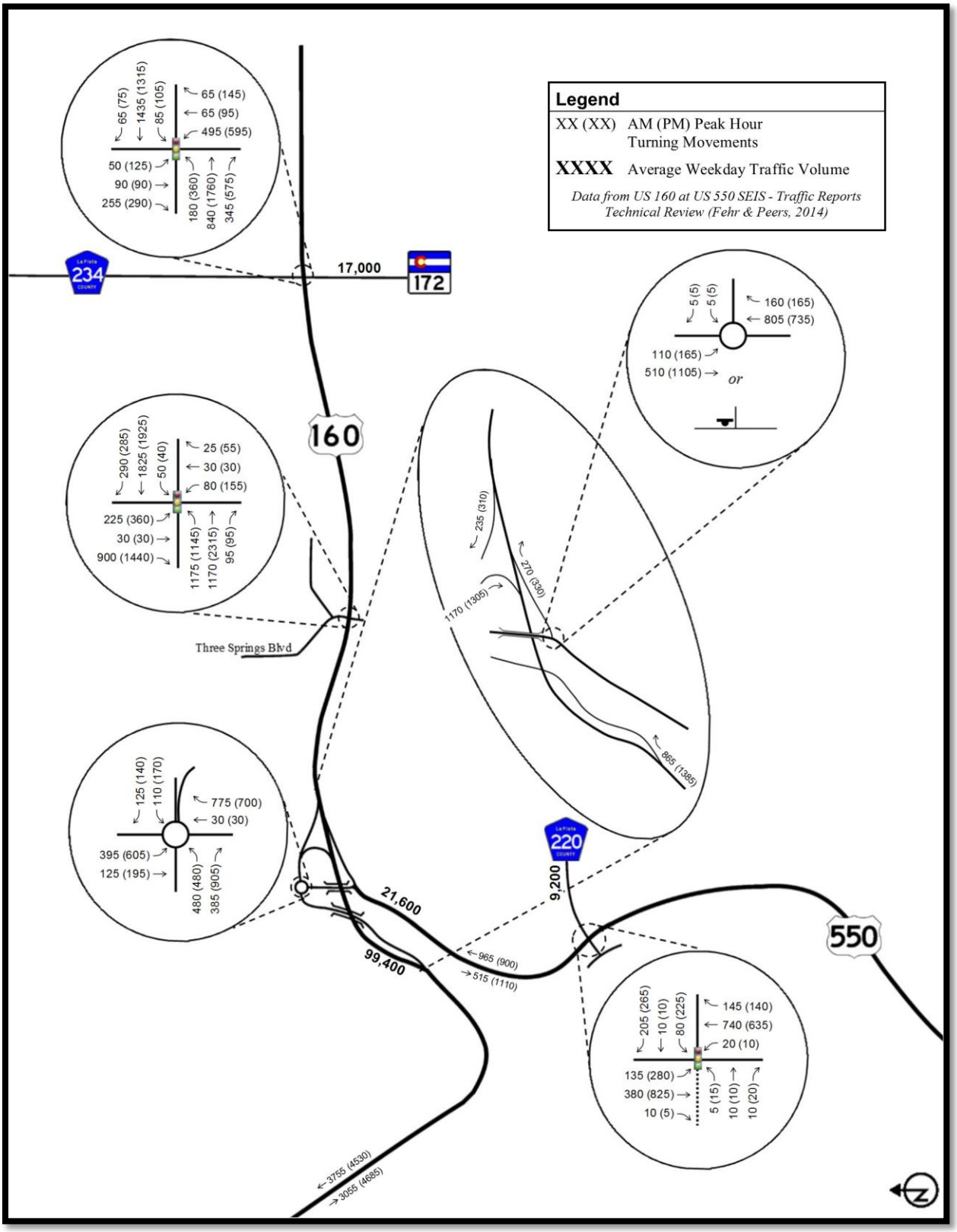


Figure 3-6: 2035 Traffic Volumes for Off-Alignment Alternatives



3.2.2 Operations Analysis

Traffic operations were reviewed in detail for the intersections, interchange ramp terminals, and highway segments along US 160 and US 550 within the study area. According to CDOT guidelines, the LOS results for all intersections, unsignalized intersection movements, and highway segments must be LOS D or better in order to meet Purpose and Need.

2035 No-Action Alternative LOS Results

The traffic operations within the study area under forecasted 2035 traffic conditions, with no geometric improvements, are shown in **Figure 3-7**. It should be noted that even in the No-Action Alternative, the geometry at the existing Grandview interchange roundabout was modified to provide access for the Three Springs development traffic on the north leg due to the planned construction of Wilson Gulch Rd. in 2014/2015. The roundabout was modeled[1] as a multi-lane facility with no additional bypass lanes as per the Wilson Gulch Rd. development plans.

Intersection LOS Results

No geometric improvements were made to the intersections for the No-Action Alternative analysis; however, signal timing operations were adjusted to account for changes in traffic volume. The intersection LOS scores, by movement and for the intersection as a whole, are provided in **Table 3-7**.

Table 3-7: No-Action Alternative Intersection LOS

Intersection	Peak Period	Eastbound			Westbound			Northbound			Southbound			ALL
		L	T	R	L	T	R	L	T	R	L	T	R	
US 160/US 550	AM	-	F	D	E	-[1]	-	E	-	A	-	-	-	**F**
	PM	-	F	D	F	-[1]	-	F	-	C	-	-	-	**F**
Grandview interchange roundabout	AM	A	-	A	-	-	A	-	-	A	A	-	-	**A**
	PM	A	-	A	-	-	A	-	-	A	A	-	-	**A**
US 160/Three Springs Blvd.	AM	F	A	A	D	F	A	D	D	A	F	D	A	**F**
	PM	F	F	A	E	F	A	F	E	A	E	D	C	**F**
US 160/SH 172	AM	F	C	C	C	F	B	D	D	A	D	E	A	**E**
	PM	F	F	D	D	E	B	D	D	A	F	D	A	**F**
US 550/CR 220	AM	-	-	-	E	-	D	-	-[2]	A	A	-[2]	-	**-**
	PM	-	-	-	F	-	D	-	-[2]	A	A	-[2]	-	**-**

[1] Westbound through is a free-flow movement at this intersection
[2] Movement not subject to intersection delay

The traffic operations deteriorate under the increased traffic load; the signalized intersections along US 160 and the unsignalized US 550/CR 220 intersection would operate at LOS E or F, with significant delays.

Highway LOS Results

Highway operations were analyzed using the same segments as in the existing conditions analysis. The westbound US 160 highway segments analyzed would also reach LOS E or F during the PM peak period (see **Table 3-8**).

[1] Roundabout operations were analyzed using RODEL software.

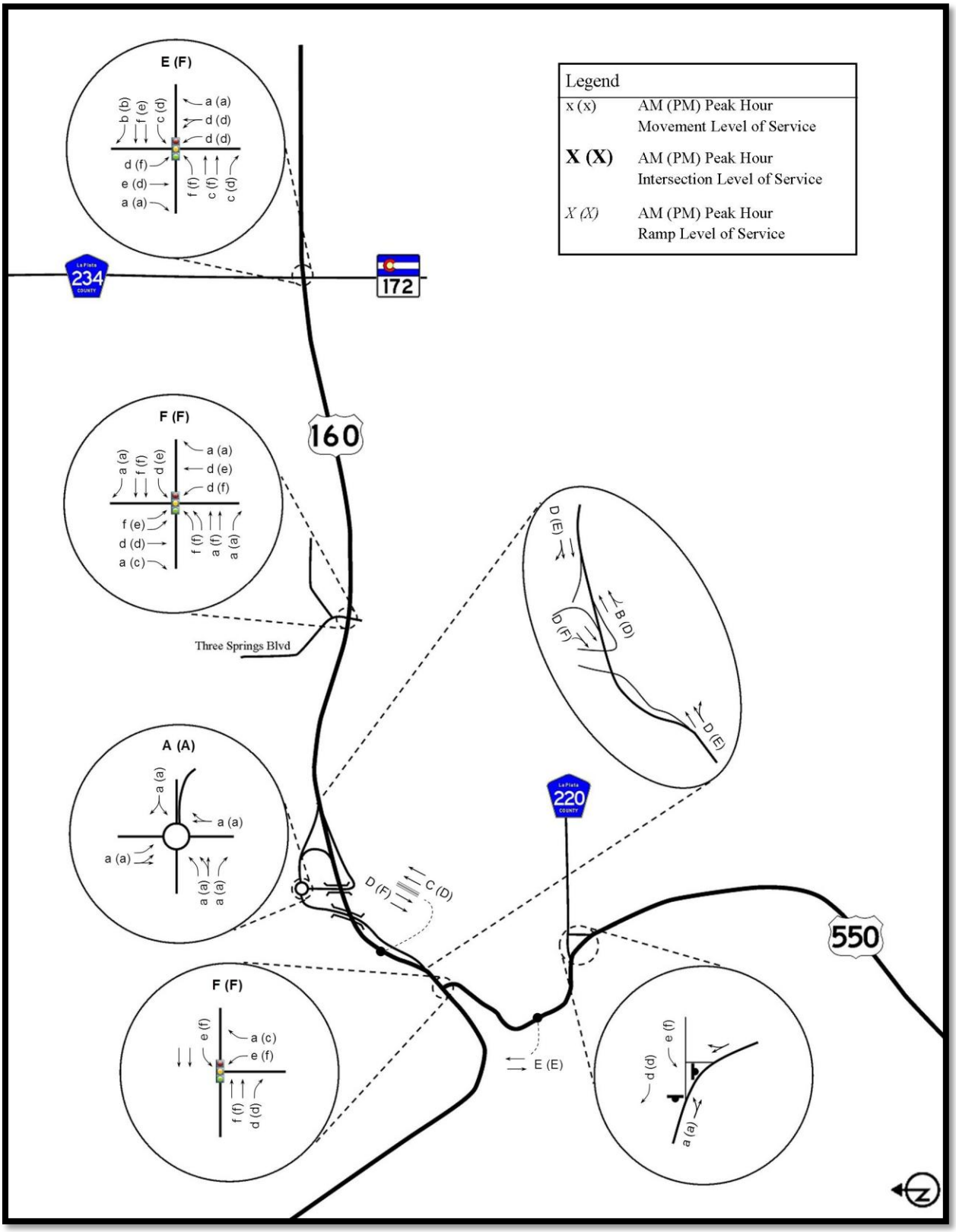
Table 3-8: No-Action Alternative Highway Segment LOS

Highway Segment	Off-Ramp		Mainline		On-Ramp	
	AM	PM	AM	PM	AM	PM
US 160 eastbound	D	E	C	D	B	D
US 160 westbound	D	E	D	F	D	F

US 550 LOS Results

In the No-Action Alternative under 2035 traffic conditions, US 550 north of CR 220 would operate at LOS E during both peak periods due to overcapacity conditions.

Figure 3-7: 2035 No-Action Alternative LOS



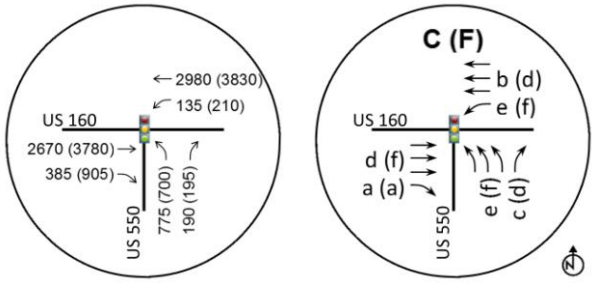
2035 On-Alignment Alternatives LOS Results

The key feature of the On-Alignment Alternative from a traffic operations perspective is that US 550 will connect to US 160 at its current location at the bottom of Farmington Hill. This would most likely take the form of a grade-separated interchange. However, it was also necessary to explore the feasibility of maintaining the connection as a signalized intersection.

Improved Signalized Configuration

At a conceptual level, a signalized intersection can take an almost infinite number of forms. However, there are, of course, practical limits on configuration options given a project's budget and the constraints of the location and proximate roadway system—in this case, the terrain (Farmington Hill and Wilson Gulch), which complicate the design of the intersection's roadway connections. US 160 is expected to have up to three through lanes in each direction, while US 550 will be constructed as a four-lane facility. The traffic operations for this type of intersection, along with the potential lane geometry and traffic volumes for reference, are shown in **Figure 3-8**.

Figure 3-8: On-Alignment Alternative Signalized Intersection Conditions



As shown, even with significant improvements, a signalized intersection would not have sufficient capacity to handle the projected 2035 traffic volumes. In addition to the significant delays on the overcapacity movements, the queue lengths along US 160 and US 550 would be extremely long, even during the AM peak period, which shows LOS C for the intersection as a whole. Even if the growth at this conceptual intersection were reduced by 40 percent, capacity would be reached for some movements during the PM peak hours.

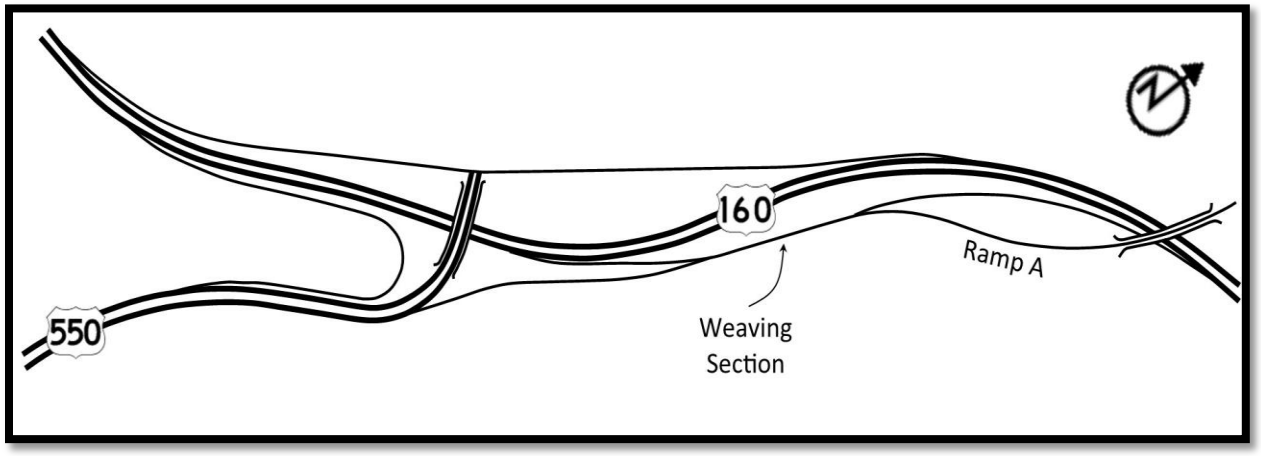
Construction of the theoretical intersection shown above would be prohibitively difficult in any case; the eight-lane cross section on US 160 would not fit within the constraints imposed by the mesa to the south or Wilson Gulch in the northeast and southwest. There would also be significant issues with constructing the triple left-turn lane necessitated by the high traffic volume.

Grade-Separated Interchange

The On-Alignment Alternative includes the construction of a grade-separated interchange at the base of Farmington Hill. One of the challenges in designing this interchange was the layout of the ramps in relation to the eastbound US 160 off-ramp to the Grandview interchange (Ramp A). There were several potential configurations for this connection; however, most were eliminated as infeasible due to constructability issues or negative impacts. The most likely configuration scenarios had in common a half diamond on the north side of US 160 for the westbound to southbound and northbound to westbound movements, and a right-side slip ramp for eastbound to southbound traffic.

The conceptual grade-separated interchange accommodates the northbound US 550 to eastbound US 160 movement by connecting it to a section of the existing Ramp A alignment, then splitting to allow traffic to access either eastbound US 160 or the Grandview interchange. This creates a short weaving section and may pose challenges for signing and striping to avoid driver confusion, but should allow sufficient distance for adequate lane change sight distance. The On-Alignment conceptual interchange layout, consistent with the R5 Alternative, is shown in **Figure 3-9**.

Figure 3-9: On-Alignment Alternative Grade-Separated Interchange



As a "build" alternative, this scenario also includes the other improvements along US 160 recommended in the *2006 US 160 EIS*, specifically the SPUI interchanges at Three Springs Blvd. and SH 172. Modification of the existing Grandview interchange roundabout to a multi-lane facility to accommodate the Wilson Gulch Rd. on the north leg was also included. Also, the volumes projected in the *US 160 at US 550 SEIS – Traffic Reports Technical Review* (Fehr & Peers, 2014) are such that the US 550 intersection with CR 220 will likely meet traffic signal warrants for operational or safety reasons.

The lane geometry on US 160 would remain largely consistent with the *2006 US 160 EIS* Proposed Alternative lane geometry, plus the additional merge/diverge segments for the US 550 on-ramps and off-ramps.

The results of the operational analysis for the On-Alignment Alternative (with a grade-separated interchange) are shown in **Figure 3-9,** along with the associated lane geometry and conceptual layout.

Intersection LOS Results

The LOS at various intersections for the On-Alignment Alternative is provided in **Table 3-9,** by movement and for the intersection as a whole. The intersections are expected to operate at LOS C or better during both peak periods, with individual movements operating at LOS D or better. There are no unsignalized intersections in this scenario.

Table 3-9: On-Alignment Alternative Grade-Separated Intersection LOS

Intersection	Peak Period	Eastbound			Westbound			Northbound			Southbound			ALL
		L	T	R	L	T	R	L	T	R	L	T	R	
US 160/US 550 ramp terminal intersection	AM	-	-	-	C	-	-	A	-	-	-	-	-	**B**
	PM	-	-	-	C	-	-	B	-	-	-	-	-	**B**
Grandview interchange roundabout	AM	A	-	A	A	-	A	-	A	A	A	A	-	**A**
	PM	A	-	A	A	-	A	-	A	A	A	A	-	**A**
US 160/Three Springs Blvd.	AM	C	-[1]	B	B	-[1]	B	C	C	C	D	C	A	**C**
	PM	D	-[1]	B	B	-[1]	C	D	C	C	D	C	C	**C**
US 160/SH 172	AM	C	-[1]	C	C	-[1]	C	C	C	C	C	C	C	**C**
	PM	C	-[1]	C	C	-[1]	C	D	C	C	C	C	C	**C**
US 550/CR 220	AM	-	-	-	D	-	A	-	A	A	A	A	-	**A**
	PM	-	-	-	D	-	A	-	B	B	A	A	-	**B**

[1] Free-flow US 160 traffic at SPUI locations

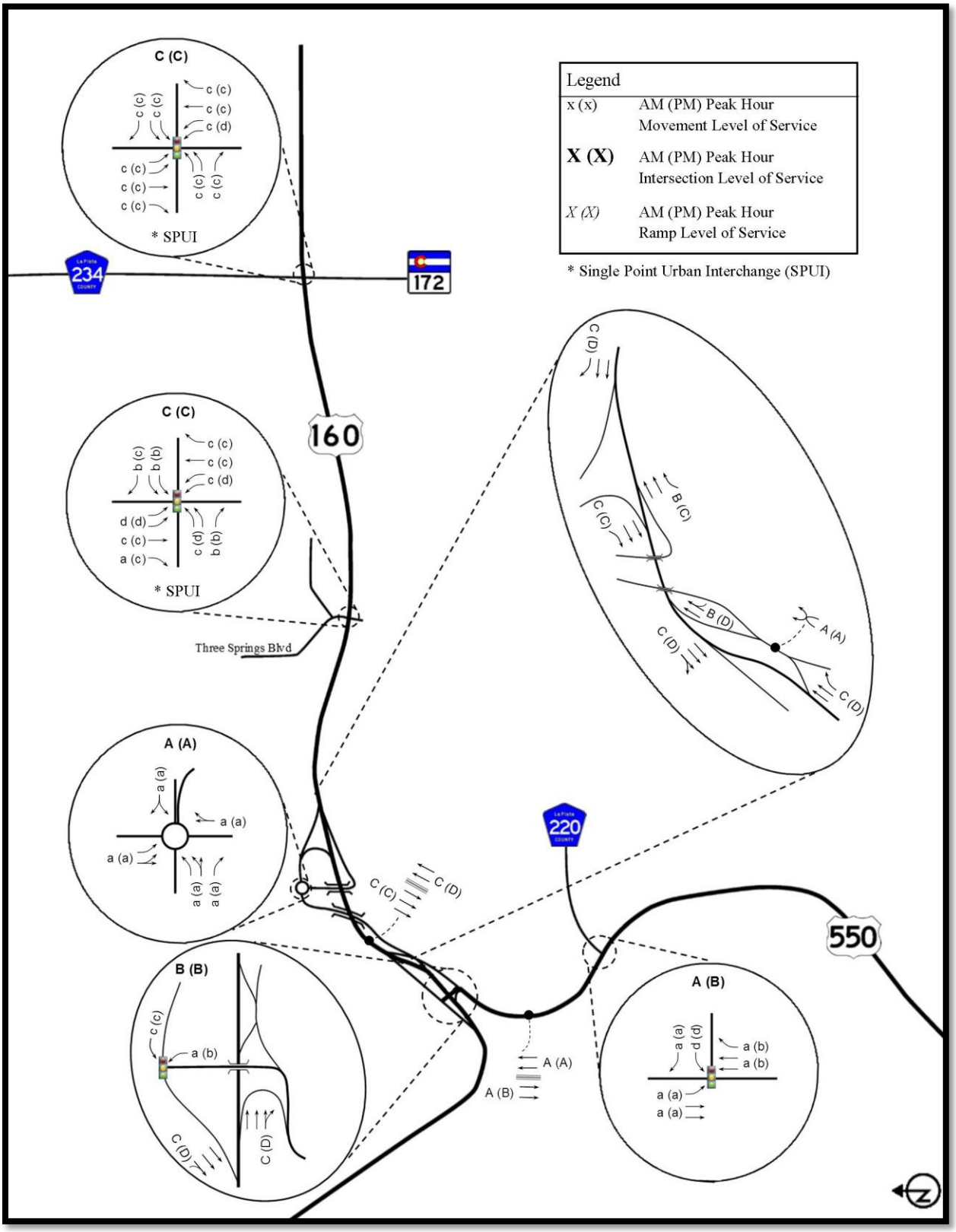
Highway LOS Results

The LOS results for the highway segments along US 160 for the On-Alignment Alternative are provided in **Table 3-10**. The highway segments are expected to operate at LOS D or better during both the AM and PM peak periods. The weaving segment on Ramp A is expected to operate at LOS A.

Table 3-10: On-Alignment Highway Segment Levels of Service

Highway Segment	Location	Peak Period	
		AM	PM
US 160 eastbound	US 550 off-ramp	C	D
	Grandview off-ramp	C	D
	Mainline	C	D
	US 550 on-ramp	B	D
	Grandview on-ramp	B	C
US 160 westbound	Grandview off-ramp	C	D
	Grandview on-ramp	C	C
	US 550 Off-Ramp	C	D
	Mainline	C	C
	US 550 on-ramp	C	D
US 550 northbound	Mainline	A	A
US 550 southbound	Mainline	A	B

Figure 3-10: 2035 On-Alignment Alternative Grade-Separated Intersection LOS



2035 Off-Alignment Alternatives LOS Results

From a traffic operations perspective, the Off-Alignment Alternatives are generally consistent with the Preferred Alternative selected from the 2012 *SFEIS,* in which US 550 connects to US 160 at the south end of the Grandview interchange. Though the precise alignment of the roadway has been developed through an iterative process, the traffic operations analysis methodology would not be significantly impacted by these variations. The main difference between the Off-Alignment Alternatives, from an operations standpoint, is the treatment of the southern ramp terminal intersection at the Grandview interchange: an unsignalized intersection or a multi-lane roundabout.

However, the conceptual layouts for the Off-Alignment Alternatives differ from the On-Alignment Alternative in several ways. The US 160 lane geometry is kept consistent with the Preferred Alternative (Alternative G Modified) from the *2006 US 160 EIS*, including the SPUI interchanges at Three Springs Blvd. and SH 172. Modification of the existing Grandview interchange roundabout to a multi-lane facility to accommodate Wilson Gulch Rd. on the north leg was also analyzed, in this case including the northbound right-turn bypass lane. Access to properties that would be eliminated in the On-Alignment Alternative is provided at the US 550/CR 220 intersection (additional west leg). This intersection would likely to meet signal warrants with the projected 2035 traffic volumes.

The results of the Off-Alignment Alternatives LOS analysis and the associated lane geometry are shown in **Figure 3-11**.

Intersection LOS Results (General)

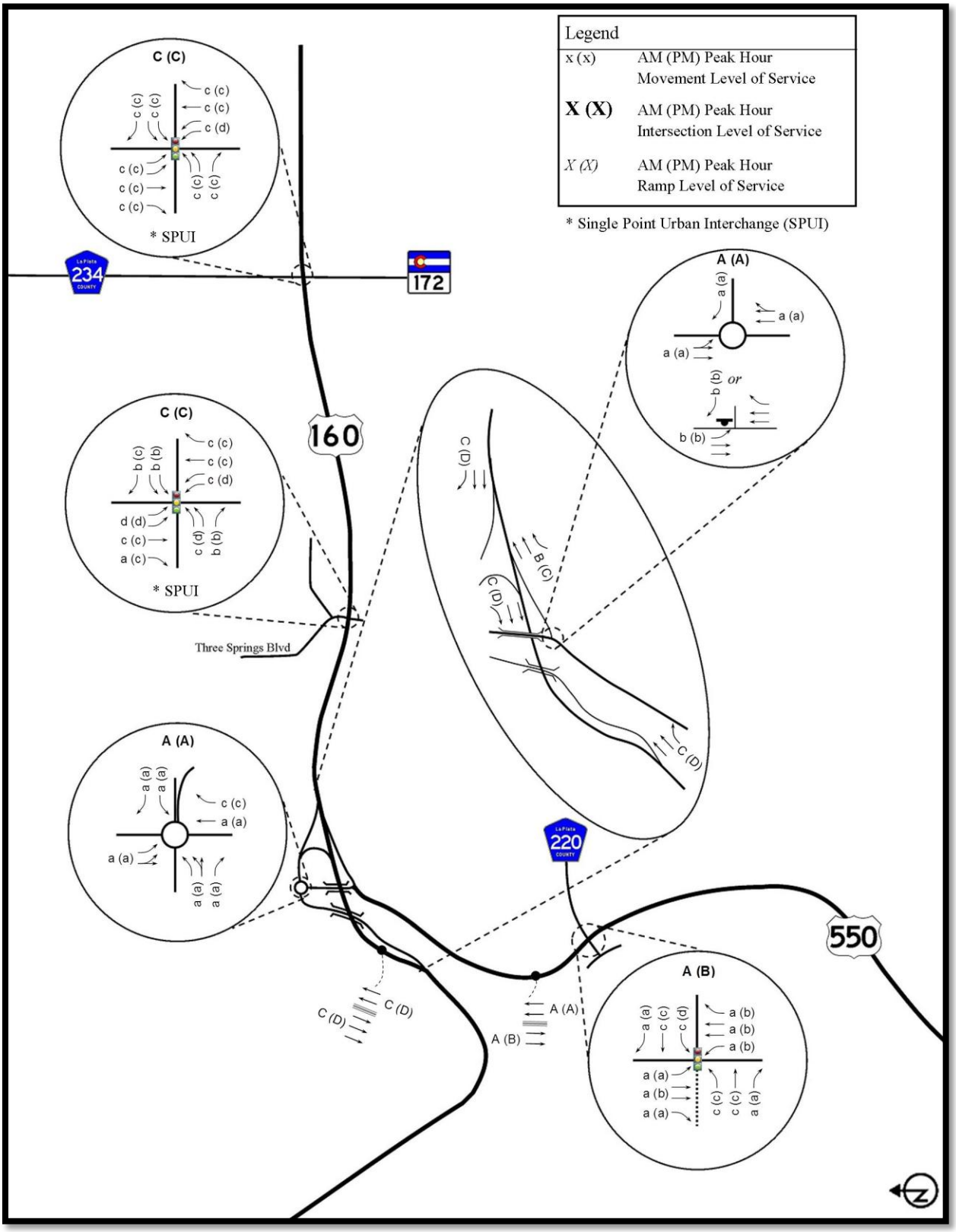
LOS for the various intersections in the Off-Alignment Alternatives is provided in **Table 3-11,** by movement and for the intersection as a whole. The intersections are expected to operate at LOS C or better during both peak periods, with individual movements operating at LOS D or better.

Table 3-11: Off-Alignment Intersection LOS

Intersection	Peak Period	Eastbound			Westbound			Northbound			Southbound			ALL
		L	T	R	L	T	R	L	T	R	L	T	R	
Grandview interchange roundabout	AM	A	-	A	A	-	A	-	A	C	A	A	-	**A**
	PM	A	-	A	A	-	A	-	A	C	A	A	-	**A**
US 160/Three Springs Blvd.	AM	C	-[1]	B	B	-[1]	B	C	C	C	D	C	A	**C**
	PM	D	-[1]	B	B	-[1]	C	D	C	C	D	C	C	**C**
US 160/SH 172	AM	C	-[1]	C	C	-[1]	C	C	C	C	C	C	C	**C**
	PM	C	-[1]	C	C	-[1]	C	D	C	C	C	C	C	**C**
US 550/CR 220	AM	C	C	A	C	C	A	A	A	A	A	A	A	**A**
	PM	C	C	A	D	C	A	B	B	B	A	B	A	**B**

[1] Free-flow US 160 traffic at SPUI locations

Figure 3-11: 2035 Off-Alignment Alternatives LOS



Highway LOS Results

The LOS results for the highway segments along US 160 for the Off-Alignment Alternatives are provided in **Table 3-12**. The highway segments are expected to operate at LOS D or better during the AM and PM peak periods.

Table 3-12: Off-Alignment Alternatives Highway Segment LOS

Highway Segment	Location	Peak Period	
		AM	PM
US 160 eastbound	Grandview off-ramp	C	D
	Mainline	C	D
	Grandview on-ramp	B	C
US 160 westbound	Grandview off-ramp	C	D
	Grandview on-ramp	C	D
	Mainline	C	D
US 550 northbound	Mainline	A	A
US 550 southbound	Mainline	A	B

South Ramp Terminal Intersection

The south ramp terminal intersection at the Grandview interchange could be constructed as an unsignalized T-intersection or a multi-lane roundabout. One of the design considerations for the eastbound on-ramp to US 160 is that there is an existing direct connection on the ramp that provides access to the Grandview interchange from the frontage road. This connection, which will likely remain in the future, creates a westbound movement that would not normally exist at a ramp-terminal intersection.

The unsignalized T-intersection would be a ¾-movement intersection: The westbound approach would not allow left turns but require all vehicles to turn right, with vehicles destined for SB US 550 making a U-turn at the existing roundabout. If the intersection were configured as a multi-lane roundabout, the left-turn movement would not require this restriction.

Table 3-13 provides a comparison of the LOS for the two configuration options at the south end of the Grandview interchange. Both options provide adequate capacity for the ramp terminal intersection on the south side of the Grandview interchange (LOS B or better).

Table 3-13: South Ramp Terminal Intersection LOS

Intersection Configuration	Peak Period	Westbound		Northbound		Southbound		ALL
		L	R	T	R	L	T	
Unsignalized T-intersection	AM	-	B	-[1]	-[1]	B	-[1]	-
	PM	-	B	-[1]	-[1]	B	-[1]	-
Multi-lane roundabout	AM	A	A	A	A	A	A	**A**
	PM	A	A	A	A	A	A	**A**

[1] Movement not subject to intersection delay

3.3 SUMMARY

The traffic counts conducted in August 2013 are representative of typical weekday traffic conditions in the peak summer season within the study area. The intersections and highway segments currently operate at an acceptable level of service (LOS C or better) during the AM and PM peak periods. This is also true for the intersections along SH 172 using the counts collected in January 2014, which represent seasonally low traffic volumes but include the additional traffic load generated by the Florida Mesa Elementary School. However, there are several individual movements at the signalized intersections that are close to exceeding the threshold for LOS D.

The future traffic operations within the study area were evaluated for the No-Action, On-Alignment, and Off-Alignment Alternatives, including a limited subset of traffic-related configuration details for the On-Alignment and Off-Alignment Alternatives. Meeting the *2012 SEIS* Purpose and Need requirement for travel efficiency and capacity, all intersections, unsignalized movements, and highway segments operate at LOS D or better during the AM and PM peak periods. **Table 3-14** provides a summary of the alternatives and the degree to which they meet the capacity element of Purpose and Need.

Table 3-14: Purpose and Need Criteria Comparison

LOS Requirement	No-Action Alternative	On-Alignment Alternatives		Off-Alignment Alternatives	
		Signal[1]	Interchange[2]	T-Intersection[3]	Roundabout[4]
		-	R5	RGM	RGM or RGM6
Intersection LOS	✗	✗	✓	✓	✓
Unsignalized movement LOS	✗	✗	✓	✓	✓
Merge/diverge LOS	✗	✗	✓	✓	✓

1 Improved signalized US 160/US 550 intersection at Farmington Hill
2 Grade-separated US 160/US 550 interchange at Farmington Hill
3 Unsignalized T-intersection: South ramp terminal at Grandview interchange
4 Multi-lane roundabout: South ramp terminal at Grandview interchange

✓ LOS D or Better
✗ LOS E or Worse

3.4 WORKS CITED

CDOT; FHWA. (2006). *Final Environmental Impact Statement/Final Section 4(f) Evaluation for US Highway 160 from Durango to Bayfield, La Plata County, Colorado. Report Number FC-NH(CX) 160-2(048).* US Department of Transportation and Colorado Department of Transportation.

(Fehr & Peers, 2014). *US 160 at US 550 SEIS - Traffic Reports Technical Review.* (Apendix F)

TRB. (2010). *Highway Capacity Manual.* Washington, D.C.: Transportation Research Board.